Vulnerability of Benin's agricultural sector to climate change and options for adaptation

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What is the issue?

In Benin, the agricultural sector contributes more than 33% of GDP (ONASA, 2008) and is also the most vulnerable to climate change. Yields for maize, the country's main food crop, may fall by as much as 6% by 2025, especially in Zone 5 of Benin (see Map 1) (Benin's 2nd National Communication on Climate Change, 2011). Farmers and agricultural advisory services can no longer rely on traditional knowledge and techniques, in large part due to shifting seasons, highly variable weather, and climate change impacts such as drought, floods, and strong winds.

The project *Strengthening Economic Skills and Climate Change Adaptive Capacity in Benin*, funded by the International Development Research Centre (IDRC) and led by the NGO *Initiatives pour un Développement Intégré Durable* (IDID), is working to enhance the capacities of local stakeholders towards making agricultural systems more resilient.

What did we do?

The methodological approach used for this project is based around hands-on learning in farmer field schools, where a participating farmer is selected to lead four others. Criteria such as gender, geographical proximity, availability, and openness to innovation are used to select the leading farmer.

A total of 360 participating farmers were randomly selected and assigned to work in 72 farmer field schools across the country's three agro-climatic areas. The farmers tested a number of adaptation options, such as using different planting dates and inter-cropping (e.g. mucuña/maize, maize/*zaï* planting pits, and pigeon peas/maize). Collaboration with the *Institut National des Recherches Agricoles du Bénin* (Benin National Institute for Agricultural Research) and the *Direction Nationale de la Météorologie* (Meteorology Department) provided access to scientific publications, analytical models,

Key messages

- **Inter-cropping maize with mucuña is an effective adaptation option for withstanding long periods of drought, restoring soil, and increasing crop yields by up to 15% (gains of 48,000 XOF (US$ 96) per hectare).**
- **The *zaï* planting pit technique is a very effective adaptation option for the semi-arid areas of northern Benin, increasing crop yields by up to 25% (gains of 45,000 XOF (US$ 90) per hectare).**
- **In the villages where adaptation options were tested, the inter-cropping with mucuña and *zaï* planting pit practices spread amongst farmers without intervention from the project. Those surveyed stated that they were influenced either by farmers who took part in the research project or by the agricultural council.**
- **Microcredit is essential to support adaptation efforts by vulnerable small-scale farmers.**

and statistical and meteorological data (e.g. precipitation, temperature, agricultural yields, etc.), which informed climate simulations and scenarios.

What did we learn?

Maize yields and associated income were increased as a result of inter-cropping mucuña with maize and using the *zaï* planting pit technique

Mucuña is a ground-cover legume that maintains soil moisture, which is often used as a fertilizer since it produces nitrogen and limits the growth of weeds. When planted with maize, it can allow the crop to survive for up to 21 days without rain, which is particularly effective during times of drought or variable precipitation. This inter-cropping technique has resulted in crop yield increases of up to 15% in the south and 18% in the north, with average gains of 48,000 XOF (US$96) per hectare.

The *zaï* planting pit technique, which involves planting in pits partially filled with organic matter, is practised in semi-arid areas such as northern Benin, where soil is often highly degraded and there is advanced desertification. The technique helps to manage rainwater, making it available to plants as needed. It has led to an increased in crop yields of up to 25%, with revenue gains of 45,000 XOF (US$90) per hectare.

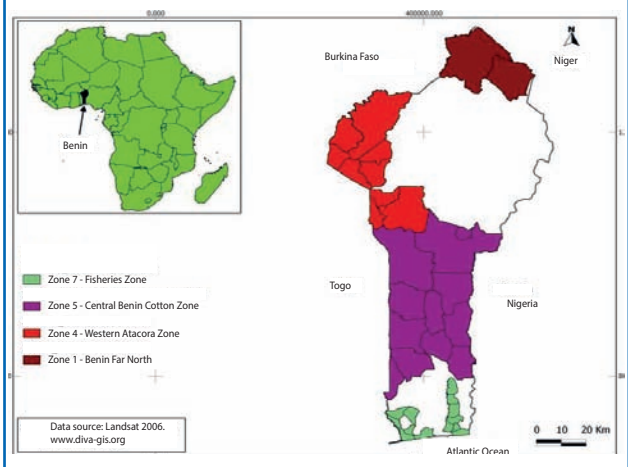

Figure 1: Benin's agro-ecological zones that are vulnerable to climate change

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Discussion group at a farmer field school in Ouaké, in the northwest of Benin

Improved agricultural planning through new planting dates

The planting dates suggested by the agricultural council are based on references dating from 1978, which no longer correspond with the current climate. Participatory trials were performed across Benin's three agro-climatic zones (e.g. north, centre, and south of the country) to help identify new and appropriate planting dates. This has helped to reduce crop losses in maize caused by decreasing precipitation and rainfall variability, while also reducing the need to reseed by 55% across all of the agro-climatic zones.

Wide dissemination of adaptation options by farmers and the agricultural council

In the pilot villages, the adaptation options of intercropping with mucuña and using *zaï* planting pits were observed to spread without any intervention from the researchers. Of the 573 farmers surveyed, 75% stated that they were influenced by farmers who participated in the trials, and 25% by the agricultural council.

Stories of change

Inter-cropping mucuña with maize has reduced crop losses from drought. In fact, farmers have been able to increase maize yields, as seen through the farmer field schools. For instance, they obtained 1.7 ton/ha by inter-cropping maize with mucuña, compared to 0.8 ton/ha for maize

Inter-cropping maize with mucuña is an effective adaptation option for withstanding long periods of drought (up to 21 days) and increasing crop yields by up to 15%, with gains of 48,000 XOF (US$ 96) per hectare

grown alone. Yields were also very good in the second year, without the application of fertilizers, and farmers noticed that the soil seemed more fertile.

"At the farmer field school, we learned agricultural practices that now give us better yields."
Stanislas Zanou, farmer, Aglamidjodji, Savalou

Farmers who use the old planting dates provided by advisory officers have been seen to regularly obtain poor yields and sometimes suffer crop losses if they plant late, due to early flooding.

"I no longer plant after the first rains. For two years now, I've used the new dates generated from the research project and have had consistently good yields."
Léocardie Ewinsou, farmer, Gobè, Savè

Stone bunds and trenches dug in flooded fields also helped to drain surplus water and limit the degree of flooding. These approaches have contributed to a 65% reduction in crop losses caused by flooding during August and September.

"I no longer fear flooding in my field."
Béatrice Souhoui, farmer, Kaïtemey, Aplahoué

Farmers understand that they can improve agricultural productivity by taking into account new climate data.

"After the early maize harvest, I now plant rice instead of maize in early July. This means that I get three harvests per year instead of two."
Female farmer, Damé

What are the policy implications?

Inter-cropping mucuña with maize and using the *zaï* planting pit technique are effective and economically profitable adaptation options. The national agricultural council is well positioned to adopt and communicate these techniques across all of Benin's agro-climatic zones, to reduce the vulnerability of the agriculture sector.

Micro-finance institutions, farm insurance providers, and umbrella farmers' organizations such as the *Fédération des Unions des Producteurs* and *Plateforme Nationale des*

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Farmers discussing the results of different adaptation options at a farmer field school in Klouékanmè, in the south of Benin

Organisations Professionnelles Agricoles will need to work together to put in place farm credit, in order to help vulnerable small-scale farmers adapt to climate change.

The agricultural council should take into account farmers' concerns and needs, as well as tested adaptation options and agricultural practices for mitigating climate risks, to improve its advisory services and the types of support that it can provide.

Local authorities need to integrate the needs of local communities – in terms of adaptation, risk management, and extreme weather – in preparing the 2015 Communal Development Plans.

What next?

- A mechanical tool will be designed to facilitate the digging of *zaï* planting pits, in order for them to be used over larger areas.
- New, edible varieties of mucuña that are suitable for human and animal consumption will make the inter-cropping technique more attractive and to promote its large-scale adoption.
- Further research is needed on non-climate vulnerabilities that influence farmers' responses to climate change. This information can be used to develop a model, to better understanding farmers' decision-making on adaptation.

Need more information?

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